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Michelle Beutler

The question of how natural colors can be brought to the cinema screen has occupied the minds of both researchers and filmmakers since the dawn of moving pictures at the end of the nineteenth century. But it was not until the latter half of the 1950s that color films established themselves as the default in film production. Nevertheless, the decade prior to that proved to be crucial for mimetic color in the cinema, not only because of the steadily growing number of color productions but also because of the formulation of standards relating to mimetic color in film.

Standardization is a term with multiple meanings: in the broadest sense, standardization describes the process of developing and implementing technical knowledge and can arise either as the result of a consensus between multiple parties or through the imposition of authority, or a combination of the two. In addition, the object of standardization processes can include everything from units of measurement to the establishment of a regular set of practices.[1] Therefore, in order to retrace how the introduction of color in film not only led to technical but also to formal aesthetic standardizations, it is necessary to look at the various factors and stakeholders involved in film production.

Technological Standardization

By the 1940s, the US American company Technicolor had established a firm grip on feature film production in Hollywood with its color film process Technicolor No. IV. In addition to this, Technicolor had also successfully expanded its services overseas to Great Britain. This success was in large part due to the engineering feat that was Technicolor No. IV. The color process employed a special camera in which a beam-splitter prism separated the incoming light onto three black-and-white negative films, thus creating separate color records for green, blue, and red. From the three black-and-white separation negatives, print matrices were formed and coated with the complementary dyes (magenta, yellow, and cyan) and, with the help of a pin belt to ensure the correct registration, transferred onto a blank film to form the final imbibition print. On an aesthetic level, the Technicolor look is

→ Fig. I

→ Fig. II

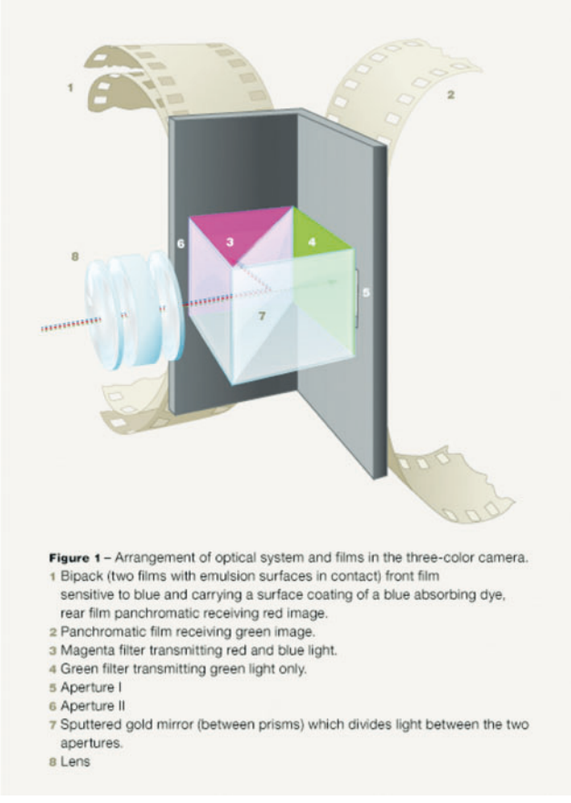


Figure 1 – Arrangement of optical system and films in the three-color camera.
1 Bipack (two films with emulsion surfaces in contact) front film sensitive to blue and carrying a surface coating of a blue absorbing dye, rear film panchromatic receiving red image.
2 Panchromatic film receiving green image.
3 Magenta filter transmitting red and blue light.
4 Green filter transmitting green light only.
5 Aperture I
6 Aperture II
7 Sputtered gold mirror (between prisms) which divides light between the two apertures.
8 Lens

Fig. I The Technicolor beam-splitter camera. Illustration by Sarah Steinbacher, Multimedia & E-Learning-Services, University of Zurich, based on J. Arthur Ball, "The Technicolor Process of Three-Color Cinematography," in *Journal of the Society of Motion Picture Engineers* 25, no. 2 (1935), 130

highly determined by its printing process (also called imbibition or dye-transfer process), resulting in the visual impression of dense, saturated colors and an opaque color application.[2]

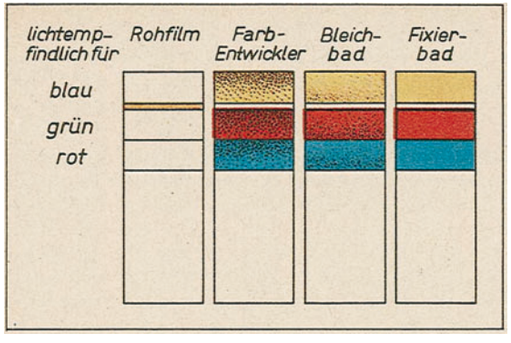
Meanwhile, a new Agfacolor process developed by I. G. Farben in Germany during the 1930s marked the first chromogenic multilayer film stock employing a negative-positive process. Like Technicolor, Agfacolor was also a three-color subtractive process; unlike Technicolor, however, it consisted of a three-layered emulsion in which the color couplers were already embedded, making it possible to shoot color film with a normal black-and-white camera. The three layers were sensitive to blue, green, and red light. Through the development process, the three primary subtractive dyes, yellow, magenta, and cyan were formed in their respective layers, and the remaining silver image was washed out. Finally, by copying the color-inverted negative, a positive print with the correct colors was produced.

→ Fig. III

→ Fig. IV

The Issue of Compatibility and Quality

One of the main functions of technological standardization is the maximization of compatibility and quality. In this regard, both Technicolor No. IV and Agfacolor exhibited some deficiencies, which—it might be argued—prevented color from becoming the norm in film production for another decade. Although in the 1940s Technicolor No. IV produced better-quality prints than Agfacolor in terms of density and color constancy, one of the main issues with the dye-transfer process was its incompatibility with current shooting practices. This was due to its cumbersome beam-splitter camera, which impeded the location shooting that had become increasingly important after World War II. Chromogenic color stock solved this issue, but Agfacolor was faced with other problems during its early years, with one of the biggest concerns being the exposure latitude of the film stock: while it was easier to correct the three Technicolor color separation negatives during development, since each color separation could undergo separate treatment, correcting underexposed Agfacolor stock was a more difficult task, often resulting in discoloration and colored shadows. Moreover, the absorption spectra of the dye couplers in the chromogenic emulsion led to issues with the registration of various colors—resulting, for example, in green grass appearing brown—and a generally pronounced muted pastel look. This was especially striking in outdoor scenes, as can be seen in GROSSE FREIHEIT NR. 7 (GREAT FREEDOM



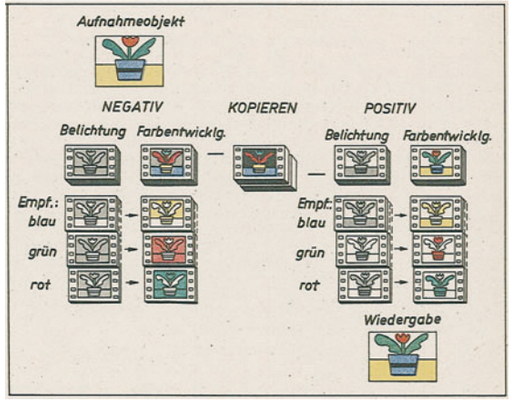


Fig. II The three color separations and the resulting Technicolor imbibition print. Technicolor, nitrate film, 35 mm. Credit: Gert Koshofer Collection. Photo: Barbara Flueckiger

Fig. III The three layers of the chromogenic Agfacolor negative. Reproduction from Richard Schmidt and Adolf Kochs, *Farbfilmtechnik: Eine Einführung für Filmschaffende*, Berlin: Max Hesses Verlag, 1943, 75

Fig. IV The Agfacolor negative-positive process. Reproduction from Richard Schmidt and Adolf Kochs, *Farbfilmtechnik: Eine Einführung für Filmschaffende*, Berlin: Max Hesses Verlag, Berlin 1943), 68

→ Fig. 1

NO. 7, Helmut Käutner, GER 1944), for example. Where Agfacolor surpassed Technicolor, however, was in its ability to depict small-scale patterns and textures, the benefits of which were most evident in the depiction of women's traditional costumes, with their colorful floral and checkered patterns and small adornments.

Film Production between Economic and Ideological Control

To ensure the quality of its output, Technicolor exercised rigid control over the use of its product. At the time of the introduction of Technicolor No. IV, the vertically integrated studio system in Hollywood functioned with an almost Fordist division of labor. Specialized personnel were responsible for every formal aspect of filmmaking. The Technicolor company integrated itself into this system by adding its own specialists into the production process: instead of selling beam-splitter cameras to the studios, Technicolor merely lent them on a production-by-production basis. For each color film production, the producers were obligated to rent not only the camera but also, during the first years of Technicolor No. IV, the services of a Technicolor cameraman and a color consultant appointed by Technicolor's own Color Advisory Service. Their main task was to ensure that Technicolor was employed to "tasteful" effect, generally meaning that color's role in film should be to support the narrative by creating and supporting appropriate moods and atmospheres and by fulfilling dramatic functions—for example, in the form of conventional symbolic meanings. This was in line with the dominant mode of film production in Hollywood, the continuity system, where formal aspects of filmmaking were subordinated to the story, and great care was taken to ensure the building of a closed and coherent fictional world. At the same time, the Technicolor staff were to make sure that the peculiarities of their color process would not become an obstacle for the cinematographer and director in getting the desired results; this included dealing appropriately with color shifts and film speed issues. The resulting Technicolor "look," although often associated with striking saturated colors, is more subdued, often favoring pastel shades and neutral or earthy backgrounds and reserving "color explosions" for the narrative climax or musical numbers, thus attaining a certain standardization on an aesthetic level. This restrictive color scheme can be observed in films of a wide variety of styles and genres, from the melodrama LEAVE HER TO HEAVEN (John M. Stahl, USA 1945) to musicals like ON THE TOWN (Stanley Donen and Gene Kelly, USA 1949)

→ Fig. 2

or Fritz Lang's western WESTERN UNION (USA 1941). However, there are nevertheless examples of Technicolor films which made more liberal and expressive use of color in the form of chiaroscuro lighting or colored lighting effects, especially in the context of genres like the musical and the fantasy film. In A MATTER OF LIFE AND DEATH (Michael Powell and Emeric Pressburger, GBR 1946), for example, cinematographer Jack Cardiff worked intricately with colored light filters to create dreamlike, eerie atmospheres.

→ Fig. 3

In Germany, meanwhile, another kind of control was exerted over the use of color film stock. The Ministry of Propaganda's interest in the ideological power of a German color film technology meant that the regime was heavily invested in the development of Agfacolor. During World War II, film production was centralized and state-controlled. Only hand-picked films were to be produced in the new German color film process. Although the control exerted over Agfacolor productions related more to the content—namely, the value of the story being told and the moral fiber of the characters and their actions—certain stylistic patterns can nevertheless be examined: most of the early Agfacolor films display an impression of rather flat images, with subdued colors and little variety in lighting and color combinations. This can be observed in the very first Agfacolor feature film production FRAUEN SIND DOCH BESSERE DIPLOMATEN (WOMEN ARE BETTER DIPLOMATS, Georg Jacoby, GER 1941) as well as Veit Harlan's OPFERGANG (THE GREAT SACRIFICE, GER 1942) and might be attributed to Agfacolor's difficulty in handling discolorations caused by low lighting situations, as well as a desire to not over-accentuate color in the name of good taste.

→ Fig. 4

While both Agfacolor and Technicolor marked a level of technological standardization not previously attained by other color film processes, their implementation was still fraught with problems—namely, with regard to compatibility and quality. Meanwhile, institutional (in the case of Technicolor) and political (in the case of Agfacolor) circumstances and prevailing notions of "good taste" heavily influenced the use of mimetic color in film and resulted in an aesthetic standardization that was independent of the technological potential of these color film processes.

1. See Andrew L. Russell, "Standardization in History: A Review Essay with an Eye to the Future," in *The Standards Edge: Future Generations*, ed. Sherrie Bolin, Ann Arbor, MI: Sheridan Press, 2005, 247–60.

2. See Barbara Flueckiger's text in this volume, "Film Colors: Materiality, Technology, Aesthetics," 17–49.

Fig. 1 Muted colors in the Agfacolor film GROSSE FREIHEIT NR. 7 (Helmut Käutner, GER 1944). Agfacolor nitrate film, 35 mm. Credit: Friedrich-Wilhelm-Murnau-Stiftung, Bundesarchiv Filmarchiv. Photo: Barbara Flueckiger and Michelle Beutler

Fig. 2 Restrictive use of Technicolor in LEAVE HER TO HEAVEN (John M. Stahl, USA 1945). Technicolor No. IV, dye-transfer print, nitrate film, 35 mm. Credit: UCLA Film & Television Archive. Photo: Barbara Flueckiger

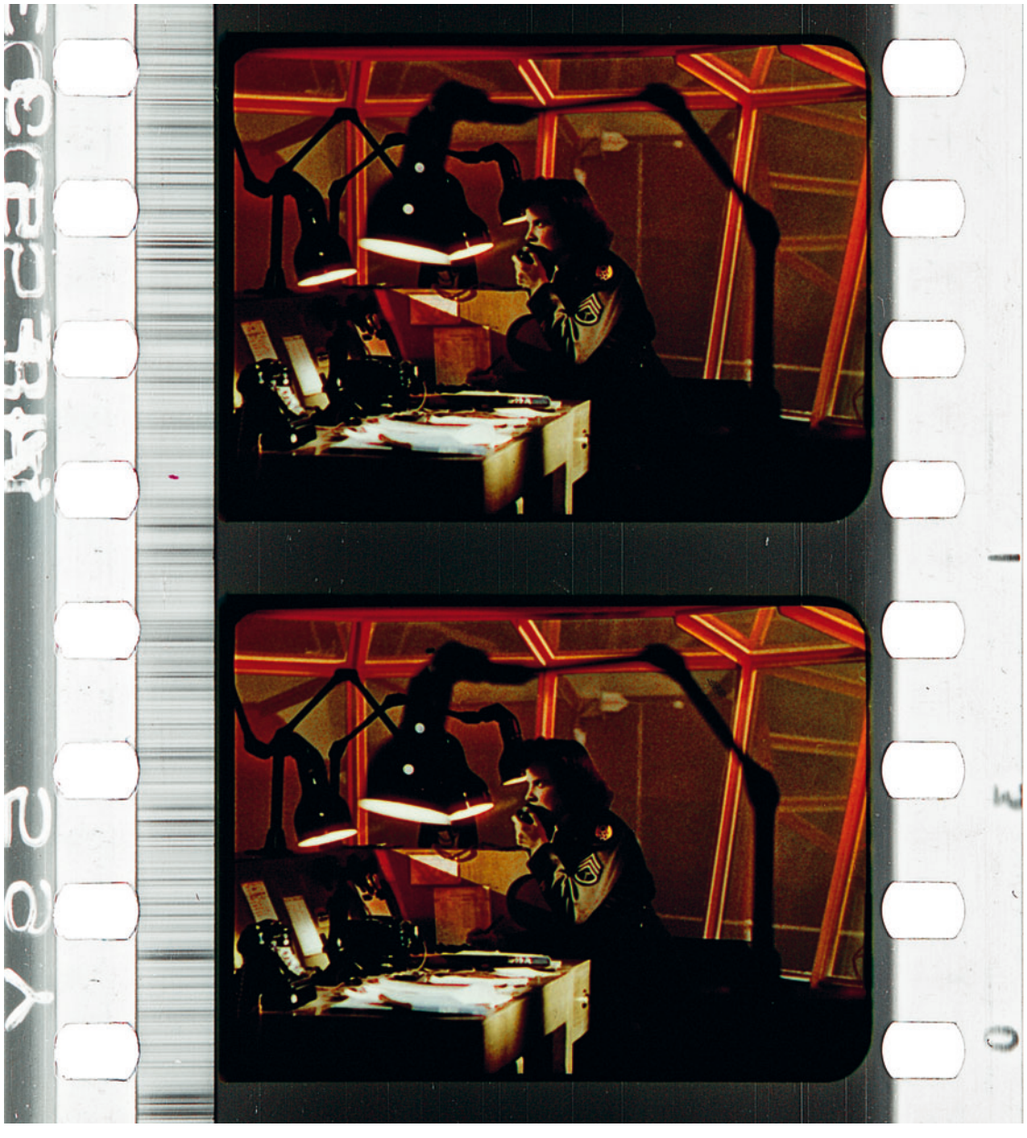


Fig 3 Colored lighting effects in the Technicolor film A MATTER OF LIFE AND DEATH (Michael Powell and Emeric Pressburger, GBR 1946). Technicolor No. IV, dye-transfer print, nitrate film, 35 mm. Credit: BFI National Archive. Photo: Michelle Beutler

Fig. 4 Pastel colors and flat lighting in the Agfacolor film OPFERGANG (Veit Harlan, GER 1944). Screenshot of the Concorde Home Entertainment BluRay, 2016